

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL REQUIREMENTS

1.1 SECTION INCLUDES

- A. Cast-in-place concrete.
- B. Formwork
- C. Conveying, curing, finishing, and protection.
- D. Mix Design, Material Testing and Certification.
- E. Reinforcement, anchorage, embedded items, accessories.
- F. Shop drawings.
- G. Repair of defective areas.

1.2 Cleaning and removal of surplus material and waste.S

- A. ACI 117 -Standard Tolerances for Concrete Construction and Materials.
- B. ACI 301 - Specifications for Structural Concrete for Buildings.
- C. ACI 302.1R - Guide for Concrete Floor and Slab Construction
- D. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
- E. OSHA 29CFR1926 - Concrete and Masonry Safety Standards, Subpart Q.
- F. ASTM C33 - Standard Specification for Concrete Aggregates.
- G. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- H. ACI 305 - Hot Weather Concreting.
- I. ACI 306.1 - Standard Specification for Cold Weather Concreting.
- J. ACI 308 - Standard Practice for Curing Concrete.
- K. ACI 309 - Standard Practice for Consolidation of Concrete.
- L. ACI 311 - Recommended Practice for Concrete Inspection.
- M. ACI SP-66 Details and Detailing of Concrete Reinforcement.

- N. ACI 318 - Building Code Requirements for Reinforced Concrete.
- O. ACI 347 - Recommended Practice for Concrete Formwork.
- P. ASTM A615 - Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcing.

1.3 QUALITY ASSURANCE

- A. Perform concrete work in conformance with ACI 301, except as modified herein or on the Drawings.
- B. The Contractor shall maintain a copy of ACI 301 in the project field office at all times.
- C. Place concrete according to ACI 304 only after mix designs and reinforcement submittals have been approved by the Engineer and the approved submittals are at the job site and the batch plant.
- D. Provide batch ticket to the Inspector written in ink with each batch delivered as specified in ASTM C94 including:
 - 1. Load Number and cubic yards of delivery;
 - 2. Compressive strength and amount of cement;
 - 3. Time truck is charged with cement;
 - 4. Admixture ingredients;
 - 5. Aggregate sizes and weights;
 - 6. Signature of ready-mix representative.
- E. Detail reinforcing according to ACI SP-66, ACI Detailing Manual.
- F. Bar splices shall meet ACI 318. Locations of all splices shall be subject to the approval of the Engineer. Mechanical Bar Splices are permitted.
- G. Modify or replace concrete not conforming to the required line, strength, finish detail or elevations within specified tolerances. Acceptance shall follow Chapter 18 of ACI 301.
- H. Surfaces shall be smooth and free from aggregate pockets and honeycomb.
- I. Repair concrete with excessive honeycombing, blistering, or other defect as determined and as directed by the Inspector, according to Chapter 9 of ACI 301.

1.4 INSPECTION AND TESTING

- A. Special Inspections will not be required for this project.
- B. All structural inspections will be implemented and performed by the owner.

1.5 SUBMITTALS

- A. Concrete Mix Design: The testing agency shall design Concrete Mixes according to Paragraph 5.3 of ASTM C94, Alternative No. 2, and ACI 318, Section 4.3, Proportioning On the Basis of Field Experience and/or Trial Mixtures. Do not commence concrete work until submittals are approved.
- B. Compressive Strength: Submit only for the concrete strengths called out on the Structural Drawings. Include test results and standard deviation analysis achieved by the concrete plant or trial mixture test data, as per Section 3.9 of ACI 301.
- C. Cement: For each shipment of cement to the batch plant, furnish certified copies of mill test reports to the Inspector prior to incorporation into the work.
- D. Blended Cement: Submit certification that the Blended Cement meets ASTM C595., stating that the amount of pozzolan in the finished cement will not vary by more than 5% by weight of the finished cement from lot to lot or within a lot.
- E. Aggregates: Include fineness modulus, specific gravity, dry rodded unit weight, and sieve analysis. Submit samples of aggregate for laboratory testing and trial mixes. Samples shall be in the quantity (and volume) as ordered by the Owner and shall be delivered in watertight containers with contents fully identified. Testing costs will be paid by the Owner.
- F. Admixtures: Submit manufacturer's certificate of conformance, including chloride ion content.
- G. Accessories: Submit manufacturer's certificate of conformance.
- H. Reinforcing Steel: For each steel shipment, submit one certified copy of a mill test report indicating physical and chemical analysis.
- I. Shop Drawings: Show bar materials, locations, sizes, quantities, bending and cutting schedules, splicing, and supporting and spacing devices. Placing and bending details shall meet ACI 315. Bar sizes, splices and splice lengths shall be clearly shown on the submittals. Do not use schedules to call out rebars. Engineer's drawings may not be reproduced in whole or in part as a shop drawing.
- J. Cylinder Tests: Submit one copy of all cylinder test reports to the Inspector, contractor, and the concrete supplier immediately after the tests are completed.
- K. Formwork: Submit certification that Formwork has been designed according to all governing codes.

PART 2 PRODUCTS

2.1 FORM MATERIALS

- A. All Materials: ACI 301 and ACI 347.
- B. Plywood: PS-1, BB Grade, Class 1.
- C. Lumber: Douglas Fir or Southern Pine, standard or construction grade, with grade stamp clearly visible.
- D. Steel: Minimum 16 gage sheet, well matched, tight fitting.
- E. Form Ties:
 - 1. Surfaces not exposed in the finished work: Snap-off metal with cone ends which will leave metal at least 1½ inches back from finished surface. Ties shall be adequate to withstand twice the computed lateral pressure from the concrete.
 - 2. Surfaces exposed in the finished work: RJD Industries Inc., Fiberglass Formtie System, Supertie XV, 15,000 pound system, no substitutions.
- F. Form Release Agent: Material which leaves no residue, does not stain concrete or impair natural bonding or color of coatings intended for use on concrete.

2.2 REINFORCING STEEL

- A. Bar Material: ASTM A615, Grade 60 deformed billet steel bars, uncoated finish.

2.3 CONCRETE MATERIALS

- A. Cement: ASTM C150, Portland Type I, II or I/II. Use one type and brand of cement throughout the project.
- B. Blended Cement: ASTM C595.
- C. Fly Ash Pozzolan: ASTM C618 Type C. Include in all mixes except slab-on-grade, at 15% to 20% proportion of the weight of cement.
- D. Fine Aggregate: ASTM C33. Natural washed sand of hard and durable particles.
- E. Coarse Aggregate: ASTM C33. Crushed rock or washed gravel, Severity Class 3S, Grading size No. 67. Gradation No. 56, 57, or 467 may be used for walls and footings over 12 inches thick.
- F. All admixtures and curing compounds shall be from one manufacturer or else the Ready Mix Concrete Producer shall certify compatibility.

- G. Water: Clean and free of deleterious amounts of acids, alkalis or organic materials.

2.4 ADMIXTURES

- A. Air Entraining Agent: ASTM C260. Air Mix by Euclid, Micro Air by Master Builders, Daravair by W.R. Grace, or approved equal.
- B. Water Reducing Agent: ASTM C494, Type A, WRDA with HYCOL by W.R. Grace, Eucon WR-75 by Euclid, Pozzolith Polyheed by Master Builders, Plastocrete 161 by SIKA, or approved equal.
- C. Set Retarding Agent: ASTM C494, Type D. Eucon Retarder 75 by Euclid, Pozzolith 100-XR by Master Builders, Daratard 752 by W.R. Grace, or approved equal.
- D. Accelerating Agent: ASTM C494 Type C or E. Accelguard by Euclid, Pozzutec 20 by Master Builders, Daraset by W.R. Grace, or approved equal.
- E. High Range Water Reducing Agent: ASTM C494, Type F or G. Eucon-37 by Euclid, Rheobuild by Master Builders, Daracem-100 by W.R. Grace, Sikament 320 by SIKA, or approved equal.

2.5 CONCRETE MIX

- A. Proportion Concrete according to ASTM C94, Chapter 11.
- B. Provide Compressive Strength as shown on the Structural Drawings.
- C. Maximum water-cement ratio: 6.0 gallons per bag.
- D. Slump: The working limit at the point of deposit shall be 4 inches, with a plus tolerance of one inch. The Inspector shall have the authority to reject concrete under either of the following two conditions.
 - 1. The slump does not fall within the tolerance of the working limit; that is, the slump exceeds 5 inches.
 - 2. If two consecutive truckloads exceed the working limit (4 inches), the second truckload may be rejected by the Inspector.
- E. Air Content: Concrete exposed to freezing and thawing shall have an air content at point of discharge of 6.0%±1.5%.
- F. For concrete exposed to view, maintain uniformity of color by using one source of cement and one source of aggregates, and a consistent mix proportion.

2.6 FLOOR SLAB ACCESSORIES

- A. Curing Paper: ASTM C171, Type 1.
- B. Water Vapor Retarder for use under Floor Slab: ASTM E1745, Class B.

2.7 FILL UNDER FLOOR SLABS

- A. Fill shall meet ASTM C33 Gradation No. 8 (3/8 inch nominal).
- B. Compact by wetting and rolling the fill the day before the slab is to be poured.
- C. At the time of the pour, the fill shall be free of self draining water so that the fill acts as a blotter.
- D. The Contractor shall prevent displacement of the fill into the concrete.

PART 3 EXECUTION

3.1 PREPARATION:

- A. Notify the Inspector minimum 24 hours before start of concreting operations and before each pour.
- B. All inserts, anchors, sleeves, and embedded parts shall be cleaned, inspected and approved.
- C. Remove foreign matter and standing water from the forms, and moisten the subgrade.
- D. Do not pour concrete on frozen soil.
- E. Prior to placing of footings, the subgrade shall be approved by the Inspector.

3.2 FORMWORK ERECTION

- A. Formwork shall comply with ACI 347, and be used for all concrete work, including reinforced footings.
- B. Verify lines, levels, and measurements before proceeding with formwork. Construct forms to the dimensions shown on the drawings. Align joints to prevent leakage.
- C. Coordinate work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts.
- D. The Contractor is responsible for the design and safe installation of forms and shores to safely support forces from placement and vibration of concrete, of sufficient rigidity to maintain finished tolerances of ACI 347.

- E. Clean forms of any mortar from previous concreting operations and of any other foreign material.
- F. Apply form coatings, sealers, and release agents according to manufacturer's printed instructions before placing reinforcing steel, anchoring devices and embedded items.

3.3 REINFORCEMENT

- A. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- B. Place bars as shown on the drawings according to the Concrete Reinforcing Steel Institute's "Manual of Standard Practice."
- C. Tie reinforcing bars with 18 gage black annealed wire. Hold in place by specified spacers. Position, support, and secure reinforcing against displacement by forms and concrete placement operations.
- D. Placing Tolerances: ACI 117, Paragraph 6.1.2.
- E. Do not use bars with kinks or bends not shown on the drawings, or bars with reduced cross sections. Do not bend or straighten bars unless approved by the Inspector. The minimum cold bend radius is 4 inches.
- F. All welding of reinforcing bars shall comply with ANSI/AWS D1.4.

3.4 MIXING AND CONVEYING

- A. Mix and Deliver ready mixed concrete according to ASTM C-94. The supplier shall maintain records for each pour, including date, location, quantity, air temperature, test samples and mix proportions.
- B. Mix concrete until there is a uniform distribution of materials and discharge completely before recharging mixer.
- C. Upon approval of the Inspector, water may be added to the mix on arrival at the job site only when the slump is within specification. The specified slump and water cement ratio shall be maintained. Reference ACI 301, Article 7.5.2.
- D. Convey concrete from the mixer to the forms by methods which will prevent separation or loss of material. Do not drop concrete freely over spacers, reinforcing or embedded items. Use dropchutes or trunks.
- E. All equipment for conveying concrete shall be of size and design as to ensure a practically continuous flow of concrete at delivery and without separation of material.

- F. All concrete shall have the air content verified prior to placement.

3.5 CONCRETE PLACING

- A. Place concrete according to ACI 304.
- B. No more than 90 minutes shall elapse between the time water is added to the mix and the concrete is poured.
- C. If the concrete temperature exceeds 90°F during the pouring period, no more than 45 minutes shall elapse between the time water is added to the mix and the concrete is poured, except concrete containing the specified High Range Water Reducer.
- D. If the daily ambient temperature is under 40°F during the 7 day curing period, provide cold weather protection according to ACI 306.1.
- E. If the ambient temperature exceeds 90°F during the 7 day curing period, provide protection according to ACI 305. The as-placed concrete shall not exceed 85°F, except concrete containing the specified High Range Water Reducer.
- F. Deposit concrete in horizontal layers not deeper than 24 inches. Avoid inclined construction joints. Place each layer while the underlying layer is responsive to vibration, and integrate the layers by proper vibration.
- G. Thoroughly vibrate concrete into place around reinforcement and into corners of formwork according to ACI 309.
- H. For concrete with epoxy coated reinforcing, use vibrators with coated heads.
- I. Do not apply vibrators to steel which extends into partially hardened concrete.

3.6 FORM REMOVAL

- A. Do not remove forms until concrete has gained sufficient strength to support its own weight and any other loads to which it might be subjected. Remove forms according to the recommendations of Paragraph 3.6.2.3 of ACI 347.
- B. Forms for the bottom of slabs, pan joists and beams shall not be removed until the concrete has gained a minimum of 75% of the required 28-day compressive strength, but in no case shall be removed before ten days after placement of concrete.
- C. Upon form removal, there shall be no excessive deflection of deformation and no evidence of damage to the concrete.

3.7 CURING

- A. Cure concrete according to ACI 308 for 7 days, minimum. It is particularly important to prevent moisture loss during the period from 3 or 4 hours to 10 hours after placement.
- B. Formed Concrete: Wood forms left in place during the curing period shall be kept continuously wet. If forms are removed before the end of the curing period, provide some other approved form of curing.
- C. Floor Slab: Cure the floor slab according to ACI 308. Ensure that the surface remains covered by free water up until the time of setting.
- D. For floors cured with curing compounds:
 - 1. Do not apply curing compound until surface has ceased to bleed.
 - 2. Do not allow the surface to dry prior to application.
 - 3. Apply the specified curing compound immediately upon the disappearance of surface water sheen at a thickness to assure compliance with ASTM C-309.
 - 4. Remove the Curing agent with a stiff broom prior to applying cementitious toppings.

3.8 SLAB FINISHING

- A. Provide broom finish to sidewalks and loading docks, and coarse broom finish to ramps.

END OF SECTION 03300